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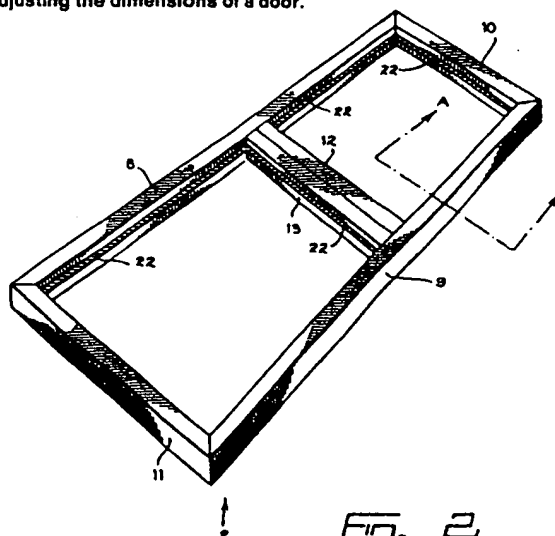
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54 Adjustable door having an increased rigidity and method of adjusting the dimensions of a door.

55 A method is provided to easily fit a door on its surrounding frame by means of an elongated T-molding. Such a T-molding comprises a channel strip having an outer surface defining a portion of the peripheral edge of the door, and an inner surface on which is fixed a longitudinal leg or a plurality of pins. A first alternative is to cut a longitudinal external groove into a vertical, peripheral stile of the door, and to insert the longitudinal leg more or less deeply into the groove so as to adjust the dimensions of the door. Another alternative is to bore holes into the stile and to insert the pins of the T-molding more or less deeply into these holes. The leg and the pins are provided with outer ridges to fixedly attach the T-molding. The pins and holes are particularly suitable for an improved door having an inner frame made of tubular members each defining a cavity which communicates with empty spaces defined within the door through a longitudinal opening of the member. By filling with polyurethane foam these spaces, openings and cavities, the tubular members are fixedly attached to the door and the rigidity of the latter is increased.



D description

Adjustable door having an increased rigidity and method of adjusting the dimensions of a door.

The present invention relates generally to the increase of the rigidity of a door and to the adjustment of the dimensions of a door so as to fit it on its surrounding frame.

Most of the known interior doors presently available on the market comprise an inner frame made of a plurality of elongated wood members. Two skins which are usually made of wood material are fixedly mounted on this inner frame to define the two opposed faces of the door. The empty spaces present within the door may be filled with a suitable filling material. However, in such a door design, the filling material fails to increase significantly the overall rigidity of the door as it is not fixedly attached to the different wood members of the inner frame, which overall rigidity is determined to a great extent by the assembly including the inner frame and the two skins.

Conventionally, a door is fitted on its surrounding frame by cutting or removing material from the peripheral edge of the door. It is well known that such an adjustment is time-consuming and often necessitates a certain skill in the handling of the tools used for this purpose.

An object of the present invention is therefore to increase the overall rigidity of a door by providing a polyurethane foam core fixedly attached to the inner frame of the door.

Another object of the present invention is to allow an easy adjustment of the dimensions of a door by means of a T-molding without having to cut or remove material from the door.

More particularly, according to the present invention, there is provided a door provided with a first face, a second face opposite to this first face, and a peripheral edge, comprising:

an inner frame including a plurality of elongated tubular members; and

a first skin and a second skin both designed to fit on the inner frame and both fixedly mounted on the elongated tubular members, the first skin having an outer surface defining the first face of the door and the second skin having an outer surface defining the second face of the door;

the first and second skins together with the elongated tubular members delimiting within the door at least one empty space;

each elongated tubular member defining an internal longitudinal cavity and comprising wall means integral with the tubular member, interposed between the internal longitudinal cavity and said at least one empty space, and provided with at least one opening therethrough whereby the internal longitudinal cavity communicates with said at least one empty space through said at least one opening;

said at least one empty space defined within the door as well as the internal cavities and openings of the tubular members being filled with polyurethane foam to fixedly attach the elongated tubular members of the frame to the door while increasing the rigidity of this door.

In accordance with a preferred embodiment of the

door of the invention, this door has a geometrical plane, and the plurality of elongated tubular members comprises two peripheral, vertical elongated tubular members, at least one of these two vertical tubular members having a substantially rectangular cross-section and comprising (a) a first longitudinal, substantially planar wall having a first outer surface defining a peripheral edge surface of the inner frame of the door, (b) a second longitudinal, substantially planar wall perpendicular to the first wall and having a second outer surface on which the first skin is fixedly mounted, and (c) a third longitudinal, substantially planar wall perpendicular to the first wall and having a third outer surface opposite to the second outer surface and on which the second skin is fixedly mounted, said door being provided with elongated cylindrical holes bored through the first outer surface and which extend perpendicularly with respect to said first planar wall, the door further comprising a T-molding including:

a channel strip having a first longitudinal, substantially planar flange parallel to the geometrical plane for covering a peripheral portion of the outer surface of the first skin, a second longitudinal, substantially planar flange parallel to the geometrical plane for covering a peripheral portion of the outer surface of the second skin, and a longitudinal central wall interconnecting the first and second flanges and having a substantially planar inner surface perpendicular to the first and second flanges and facing the first outer surface, the central wall further comprising a substantially planar outer surface opposite to the inner surface of this central wall and defining a portion of the peripheral edge of the door; and a plurality of pins extending perpendicularly from the inner surface of the longitudinal central wall and positioned and dimensioned for insertion into the holes whereby the position of said strip can be adjusted through adjustment of the extent of insertion of the pins into the holes in order to adjust the dimensions of the door.

The present invention also proposes a method of adjusting the dimensions of a door mounted on a surrounding frame by means of an elongated T-molding so as to fit the door on the surrounding frame, this door comprising a first face, a second face opposite to the first face, a peripheral edge, and an inner frame provided with two vertical, elongated peripheral stile members, at least one of these stile members having a longitudinal outer surface defining a peripheral edge surface of the inner frame of the door, the T-molding comprising (a) a strip having a first elongated surface facing said outer surface of said one stile member and a second elongated surface opposite to the first surface and which defines a portion of the peripheral edge of the door, and (b) leg means provided with outer ridges and mounted on the first surface of the strip, the method comprising the steps of:

boring hole means through the outer surface of said one stile member, these hole means having inner walls and being designed so that the leg means can

be inserted into these hole means and so that the ridges of the leg means cooperate with the inner walls of the hole means to firmly hold the leg means into the hole means in order to fixedly attach the T-molding to the door when the leg means are partly or completely inserted into the hole means, and inserting the leg means into the hole means to an extent which positions said strip so as to provide to the door dimensions which fit on the surrounding frame.

The boring step may comprise the step of cutting a longitudinal groove through the outer surface of said one stile member and the leg means of the T-molding may comprise a longitudinal leg provided with outer longitudinal ridges and designed for insertion into the longitudinal groove.

The boring step may also comprise the step of boring a plurality of holes through the outer surface of said one stile member and the leg means of the T-molding comprise a plurality of pins provided with outer ridges, these pins being dimensioned and positioned on the first surface of the strip so as to fit into the holes.

The objects, advantages and other features of the present invention will become more apparent upon reading of the following non restrictive description of preferred embodiments thereof, made in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a door according to the present invention having an inner frame made of elongated tubular members, and a T-molding for adjusting the dimensions of the door;

Figure 2 shows the structure of the inner frame of the door of Figure 1 which is made of elongated tubular members;

Figure 3 is a cross-section of one tubular member of the frame of Figure 2 taken for the purpose of exemplification along axis A-A of Figure 2;

Figure 4 is a cross-section of the door of Figure 1 taken along axis B-B;

Figure 5 shows an enlarged view of the cross-section of the T-molding of the door of Figure 1 taken along the axis B-B;

Figure 6 illustrates an application of the adjusting method according to the present invention to a door having an inner wood frame, which adjustment is carried out by means of a T-molding;

Figure 7 shows the structure of the wood frame of the door of Figure 6;

Figure 8 is a cross-section of the door of Figure 6 taken along axis C-C; and

Figure 9 is an enlarged view of the cross-section of the T-molding of the door of Figure 6, which cross-section is taken along axis C-C of Figure 6.

Figure 1 illustrates a door generally designated by the reference 1, which door comprises an inner frame 2 made of a plurality of elongated tubular members. A first skin 3 designed to fit on the inner frame 2 is fixedly mounted on this frame and has an outer surface which defines a first face of the door 1. In the same manner, a second skin 4 also designed

to fit on the frame 2 is also fixedly mounted on this frame and has an outer surface which defines a second face of the door 1.

As shown on Figure 1, the two skins 3 and 4 may have an outer surface provided with decorative patterns so that the first and second faces of the door 1 are also provided with such decorative patterns.

The two skins 3 and 4 are advantageously constituted by a sheet of P.V.C., or polystyrene shaped by vacuum forming in order to provide the above-mentioned decorative patterns. As it is well known, in such a vacuum forming process, a sheet of the material constituting the skin 3 or 4 is supported over a mold and is heated to a temperature at which it can be reshaped. This mold is provided with means permitting to establish a vacuum between the sheet and the mold that will pull-in the softened sheet to the mold contour where it hardens to the desired shape.

The dimensions of the door 1 are adjusted by means of a T-molding 5 including a channel strip 6 and a plurality of pins such as 7 which can be inserted into holes drilled through the peripheral edge of the frame 2 so as to fix the T-molding 5 on the door 1, as will be seen hereinafter.

Figure 2 illustrates the structure of the frame 2 of the door 1. This frame 2 comprises two vertical stile members 8 and 9 having upper ends interconnected through an upper cross-member 10, lower ends interconnected through a lower cross-member 11, and central portions interconnected through two central cross-members 12 and 13. The stile members 8 and 9 as well as the cross-members 10 to 13 are all made of elongated tubular members suitably made of moldable rigid plastic material.

The different tubular members of the frame 2 are glued together. The confronting surfaces of the two central cross-members 12 and 13 are also conveniently glued together.

As shown on Figure 3, the cross-section of each tubular member 8 to 13 taken for example along axis A-A of Figure 2 is rectangular. Each tubular member 8 to 13 comprises a first elongated, planar wall 14, perpendicular to the geometrical plane of the door 1 and having an outer surface 15, a second elongated, planar wall 16 perpendicular to the first wall 14 and having an outer surface 17 on which is glued the skin 3, a third elongated planar wall 18 also perpendicular to the first wall 14 and having an outer surface 19 on which is glued the skin 4, and wall means including two planar wall portions 20 and 21 both lying into a same plane perpendicular to the walls 16 and 18. A longitudinal spacing is provided between these two wall portions to define a longitudinal opening 22 of the tubular member. Each tubular member of the frame 2 therefore defines an internal cavity 23.

The cross-section of Figure 4 shows an inner empty space delimited within the door 1 by the skins 3 and 4 together with the tubular members of the frame 2. Each inner empty space of the door 1 communicates with the internal cavity 23 defined within the adjacent tubular members of the frame 2 through the corresponding longitudinal openings 22.

This is shown on Figure 4 by way of example for the stile members 8 and 9.

The inner empty spaces of the door 1, the internal cavities 23 and openings 22 of the tubular members 8 to 13 are filled with expandable polyurethane foam 50 whereby the tubular members of the frame 2 are fixedly attached to the door 1 through the polyurethane foam material, and whereby the polyurethane foam material provides to the door a rigid core fixedly attached to the tubular members of the frame 2 for increasing the rigidity of the door 1.

Cylindrical holes such as 24 are drilled through the outer surface 15 of the tubular stile member 9. Of course, these holes 24 are positioned and dimensioned so that the pins 7 of the T-molding can be inserted therein.

Figure 5 is an enlarged view of the cross-section of the T-molding 5 as shown on Figure 4. The channel strip 6 of the T-molding comprises a first planar flange 25 for covering a peripheral portion of the outer surface of the skin 3 and a second planar flange 26 for covering a peripheral portion of the outer surface of the skin 4 in order to provide an attractive finish to the door when the T-molding 5 is mounted thereon. The channel strip also comprises an elongated central wall 27 interconnecting the flanges 25 and 26. This central wall has an inner planar surface 28 perpendicular to the flanges 25 and 26 and an outer planar surface 29 angularly disposed with respect to the surface 28 in order to provide the required clearance with respect to the surrounding frame for an easy closure of the door 1 when the latter is mounted on its surrounding frame through hinges.

The pins 7 are disposed as shown on Figure 5, perpendicular to the surface 28 and are provided with outer ridges such as 30. It can be easily appreciated that these ridges 30 hold firmly the pins 7 into the holes 24 in order to fixedly attach the T-molding 5 to the door at the required adjustment after the pins 7 have been partly or completely inserted into the holes 24. The diameter of the cylindrical holes 24 is selected for this purpose.

Upon mounting of the T-molding 5 on the door 1, the pins 7 are inserted more or less deeply into the holes 24 so as to provide to the door dimensions which fit on its surrounding frame. A hammer can be used for this purpose.

Figure 6 illustrates an application of the adjusting method according to the present invention to a door 31 provided with a wood frame 32. As shown on Figure 7, such a wood frame 32 comprises two vertical stiles 33 and 34 having upper ends interconnected through an upper cross-member 35, central portions interconnected through a central cross-member 36, and lower ends interconnected through a lower cross-member 37. The stiles 33 and 34 and the cross-members 35 to 37 are assembled together by means of glue and fasteners such as 38.

Referring back to Figure 6 of the drawings, a longitudinal groove 39 is cut in the stile 34 through an outer peripheral surface of the latter. The door 31 further comprises a T-molding 40 provided with a channel strip 41 and a longitudinal leg 42 designed to be inserted into the groove 39 as will be seen in more

details herein-after.

The door 31 also comprises a first skin 43 having an outer surface which defines a first face of the door 31 and a second skin 44 also having an outer surface which defines a second face of the door. These two skins 43 and 44 may be provided with decorative patterns as illustrated on Figure 6, and may also be made from a sheet of moldable material shaped by vacuum forming to provide the decorative patterns, as the skins 3 and 4 of the door 1 of Figure 1.

Figure 8 is a cross-section of the door 31 taken along axis C-C of Figure 6. The two skins 43 and 44 together with the wood stiles and cross-members of the frame 32 of the door 31 define empty spaces which are filled with expandable polyurethane foam 45.

Figure 9 is an enlarged view of the cross-section of the T-molding 40 as shown on Figure 8.

The channel strip 41 of the T-molding 40 comprises a first planar flange 46 for covering a peripheral portion of the outer surface of the skin 43 and a second planar flange 47 for covering a portion of the outer surface of the skin 44. These two flanges 46 and 47 are parallel to each other and to the geometrical plane of the door 31. It is evident that the flanges 46 and 47 are provided to give an attractive finish to the door 31 after the T-molding 40 has been mounted thereon.

The channel strip 41 also includes a central wall 48 which interconnects the flanges 46 and 47. This central wall 48 has an inner planar surface 49 perpendicular to the flanges 46 and 47 and an outer planar surface 51 defining a portion of the peripheral edge of the door 31, which surface 51 is angularly disposed with respect to the surface 49 in order to provide the appropriate clearance with respect to the surrounding frame upon closure of the door 31 when the same is mounted on its surrounding frame through hinges.

The longitudinal leg 42 is disposed perpendicularly on the planar surface 49 and is provided with longitudinal outer ridges such as 52 to firmly hold the leg 42 into the groove 39 in order to fixedly attach the T-molding 40 to the door 31 after this leg 42 has been partly or completely inserted into the groove 39. Of course, the dimensions of the groove 39 are selected for this purpose.

It can be easily appreciated that by introducing the leg 42 more or less deeply into the groove 39, by means of a hammer for example, a required adjustment of the dimensions of the door 31 can be obtained so as to fit it on its surrounding frame.

As shown on Figure 8, a groove may be cut in each of the two stiles 33 and 34, so that the T-molding 40 can be mounted on either one of the stiles 33 and 34, depending on the specific mounting of the door 31.

Moreover, due to the central longitudinal leg 42 of the T-molding 40 and to the central longitudinal groove 39, the inclination of the surface 51 may be reversed at will by interchanging the upper and lower ends of the T-molding 40.

In the same manner, the holes 24 of the door 1 of Figure 1 may be drilled through the outer peripheral

surface of the stile members 8 and 9 also to allow a mounting of the T-molding 5 either on the stile member 8 or 9 depending on the specific mounting of this door on its surrounding frame. Of course, the pins 7 and the holes 24 are positioned so that the inclination of the surface 29 may be reversed at will by interchanging the lower and upper ends of the molding 5.

It should also be noted that another T-molding may also be mounted on the vertical edge of the door opposite to the molding 5 or 40, such another T-molding being similar to the T-molding 5 or 40 to provide the door with a same finish on its two vertical edges, and being adapted to receive hinges which are mounted through screws traversing the T-molding and fixed to one of the wood stiles 33 and 34 or to one of the tubular stile members 8 and 9 so that these hinges are fixedly attached to the door. However, such T-moldings must comprise a channel strip provided with a central wall having inner and outer planar surfaces which are parallel to each other in order to allow an appropriate mounting of the door through these T-moldings. Such T-moldings are of course provided with external cavities to receive the hinges.

These other T-moldings may be replaced by a channel strip having the same dimensions as those of the channel strip 6 or 41 of the T-molding 5 or 40, and fixed to the door through the screws of the hinges. However, such a channel strip has a central wall including inner and outer planar surfaces which are parallel to each other, and is provided with external cavities to receive the hinges.

Although the present invention has been described hereinabove by way of preferred embodiments thereof, it should be pointed out that any modification to such preferred embodiments within the scope of the appended claims is not deemed to change the object and nature of the subject invention.

Claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A door provided with a first face, a second face opposite to said first face, and a peripheral edge, comprising:
 - an inner frame including a plurality of elongated tubular members; and
 - a first skin and a second skin both designed to fit on said inner frame and both fixedly mounted on said elongated tubular members, the first skin having an outer surface defining the first face of the door and the second skin having an outer surface defining the second face of the door;
 - said first and second skins together with said elongated tubular members delimiting within said door at least one empty space;
 - each elongated tubular member defining an internal longitudinal cavity and comprising wall

means integral with the tubular member, interposed between said internal longitudinal cavity and said at least one empty space, and provided with at least one opening therethrough whereby said internal longitudinal cavity communicates with said at least one empty space through said at least one opening;

said at least one empty space defined within said door as well as the internal cavities and openings of said tubular members being filled with polyurethane foam to fixedly attach the elongated tubular members of said frame to the door while increasing the rigidity of said door.

2. A door according to claim 1, wherein said elongated tubular members each have a substantially rectangular cross-section.

3. A door according to claim 2, wherein said door has a geometrical plane, and wherein said plurality of elongated tubular members comprises peripheral elongated tubular members each comprising:

a first longitudinal, substantially planar wall perpendicular to said geometrical plane and having an outer surface defining a peripheral edge surface of the inner frame of the door;

a second longitudinal, substantially planar wall perpendicular to said first wall and having an outer surface on which is fixedly mounted said first skin;

a third longitudinal, substantially planar wall perpendicular to said first wall and having an outer surface on which is fixedly mounted said second skin;

a first longitudinal, substantially planar wall portion connected to said second wall and lying into a plane perpendicular to said geometrical plane;

a second longitudinal, substantially planar wall portion connected to said third wall and lying into said plane perpendicular to said geometrical plane;

said first and second wall portions constituting said wall means of the peripheral elongated tubular member and being provided with a spacing therebetween which defines a longitudinal opening through these wall means, said longitudinal opening constituting said at least one opening of the peripheral elongated tubular member.

4. A door according to claim 3, in which the first skin is glued on the outer surface of the second longitudinal, substantially planar wall, and in which the second skin is glued on the outer surface of the third longitudinal, substantially planar wall.

5. A door according to claim 1, wherein said door has a geometrical plane, and wherein said wall means comprise a first longitudinal, substantially planar wall portion lying into a plane perpendicular to said geometrical plane, and a second longitudinal, substantially planar wall portion also lying into said plane perpendicular to the geometrical plane, said first and second wall portions being provided with a spacing therebetween which forms a longitudinal open-

ing constituting said at least one opening.

6. A door according to claim 1, in which each elongated tubular member has a first longitudinal outer surface and a second longitudinal outer surface opposite to said first outer surface, and in which the first skin is glued on the first outer surfaces of said elongated tubular members, and the second skin is glued on the second outer surfaces of the elongated tubular members.

7. A door according to claim 1, wherein the outer surface of at least one of said first and second skins is provided with decorative patterns whereby the corresponding face of the door is provided with such decorative patterns.

8. A door according to claim 1, in which said elongated tubular members are made of a moldable plastic material.

9. A door according to claim 1, wherein said plurality of elongated tubular members of the inner frame comprises:

first and second peripheral, vertical elongated tubular members each having an upper end, a lower end, and a central portion;

a first peripheral, horizontal elongated tubular member interconnecting the upper ends of said first and second vertical tubular members;

a second peripheral, horizontal elongated tubular member interconnecting the lower ends of said first and second vertical tubular members; and

at least one horizontal elongated tubular member interconnecting said central portions of the vertical elongated tubular members.

10. A door according to claim 1, in which said plurality of elongated tubular members comprises two vertical peripheral elongated tubular members, at least one of said two vertical peripheral tubular members having a first longitudinal outer wall surface defining a peripheral edge surface of the inner frame, said door being provided with elongated cylindrical holes bored through said first surface of said one vertical tubular member, said door further comprising an elongated T-molding having (a) a strip which includes an outer surface defining a portion of said peripheral edge of the door, and (b) a plurality of pins dimensioned and positioned on said strip for insertion into said holes whereby the position of said strip can be adjusted through adjustment of the extent of insertion of said pins into said holes in order to adjust the dimensions of the door.

11. A door according to claim 10, wherein each of said pins comprises outer ridges for holding firmly said pins into said holes for thereby fixedly attaching said T-molding to the door.

12. A door according to claim 1, in which said door has a geometrical plane, and in which said plurality of elongated tubular members comprises two peripheral, vertical elongated tubular members, at least one of said two vertical tubular members having a substantially rectangular cross-section and comprising (a) a first longitudinal, substantially planar wall having a

first outer surface defining a peripheral edge surface of the inner frame of the door, (b) a second longitudinal, substantially planar wall perpendicular to said first wall and having a second outer surface on which said first skin is fixedly mounted, and (c) a third longitudinal, substantially planar wall perpendicular to said first wall and having a third outer surface opposite to said second outer surface and on which said second skin is fixedly mounted, said door being provided with elongated cylindrical holes bored through said first outer surface and which extend perpendicularly with respect to said first planar wall, said door further comprising a T-molding including:

a channel strip having a first longitudinal, substantially planar flange parallel to said geometrical plane for covering a peripheral portion of the outer surface of the first skin, a second longitudinal, substantially planar flange parallel to said geometrical plane for covering a peripheral portion of the outer surface of the second skin, and longitudinal central wall interconnecting said first and second flanges and having a substantially planar inner surface perpendicular to said first and second flanges and facing said first outer surface, said central wall further comprising a substantially planar outer surface opposite to said inner surface of this central wall and defining a portion of said peripheral edge of the door; and a plurality of pins extending perpendicularly from said inner surface of the longitudinal central wall and positioned and dimensioned for insertion into said holes whereby the position of said strip can be adjusted through adjustment of the extent of insertion of said pins into said holes in order to adjust the dimensions of the door.

13. A door according to claim 12, in which said pins each comprise outer ridges for holding firmly said pins into said holes for thereby fixedly attaching said T-molding to the door.

14. A door according to claim 12, wherein said outer surface of the longitudinal central wall is angularly disposed with respect to the inner surface of the central wall in order to provide a certain clearance necessary for allowing an easy closure of the door when the same is mounted on a surrounding frame through hinges.

15. A method of adjusting the dimensions of a door mounted on a surrounding frame by means of an elongated T-molding so as to fit the door on said surrounding frame, said door comprising a first face, a second face opposite to said first face, a peripheral edge, and an inner frame provided with two vertical, elongated peripheral stile members, at least one of said stile members having a longitudinal outer surface defining a peripheral edge surface of the inner frame of said door, said T-molding comprising

(a) a strip having a first elongated surface facing said outer surface of said

one stile member and a second elongated surface opposite to said first surface and which defines a portion of said peripheral edge of the door, and

(b) leg means provided with outer ridges and mounted on the first surface of said strip, said method comprising the steps of: boring hole means through said outer surface of said one stile member, said hole means having inner walls and being designed so that said leg means can be inserted into these hole means an so that the ridges of said leg means cooperate with the inner walls of said hole means to firmly hold the leg means into the hole means in order to fixedly attach the T-molding to the door when the leg means are partly or completely inserted into the hole means; and inserting said leg means into said hole means to an extent which positions said strip so as to provide to said door dimensions which fit on said surrounding frame.

16. A method according to claim 15, wherein

said boring step comprises the step of cutting a longitudinal groove through said outer surface of said one stile member.

17. A method according to claim 16, in which th leg means of said T-molding comprise a longitudinal leg provided with outer longitudinal ridges and designed for insertion into said longitudinal groove.

18. A method according to claim 15, wherein said boring step comprises the step of boring a plurality of holes through said outer surface of said one stile member.

19. A method according to claim 18, wherein said leg means of said T-molding comprise a plurality of pins provided with outer ridges, said pins being dimensioned and positioned on said first surface of the strip so as to fit into said holes which are elongates and cylindrical holes.

20. A method according to claim 15, in which said strip is a channel strip comprising a first elongated flange for covering a peripheral elongated portion of the first face of the door, and a second elongated flange for covering a peripheral elongated portion of the second face of the door.

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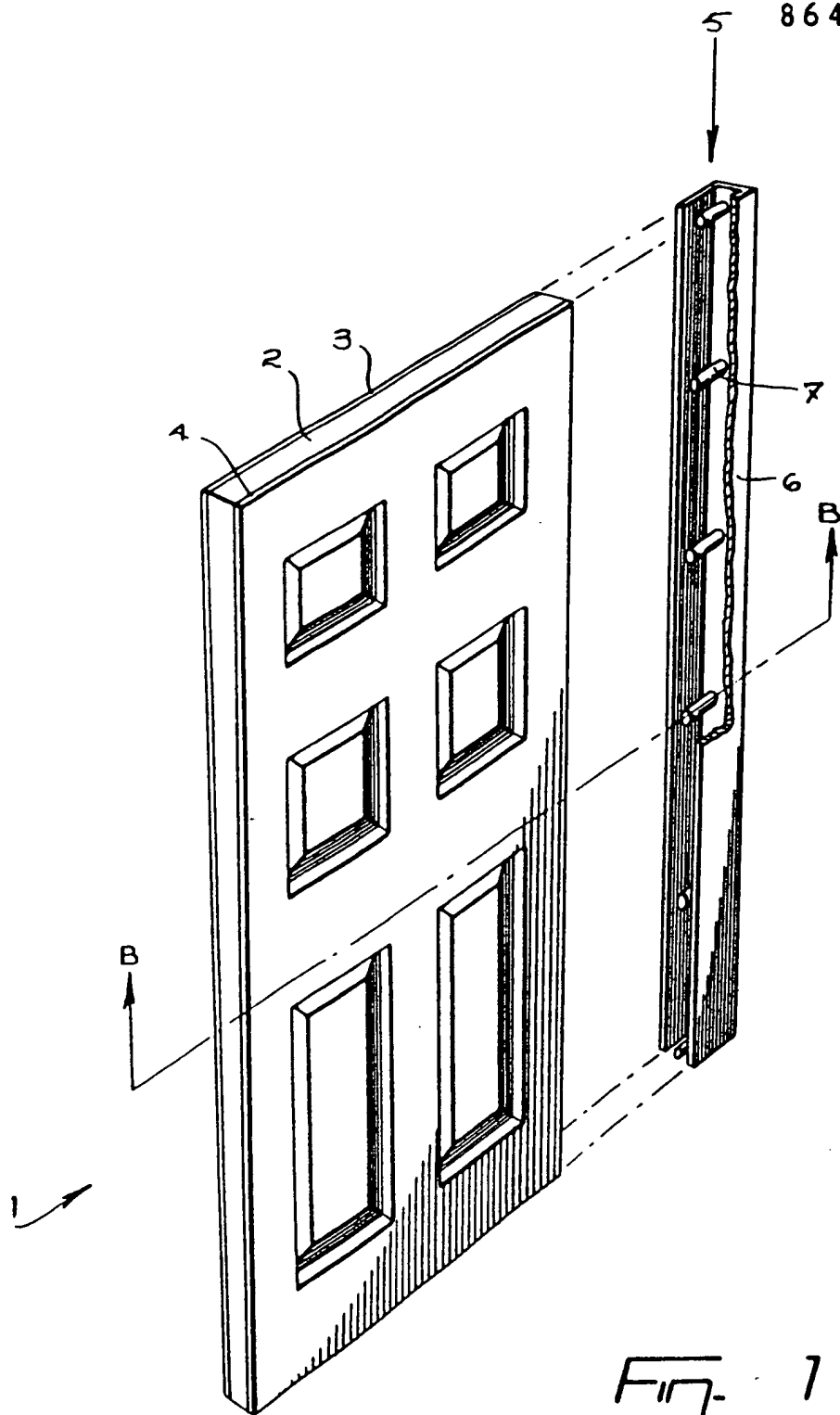


Fig. 1

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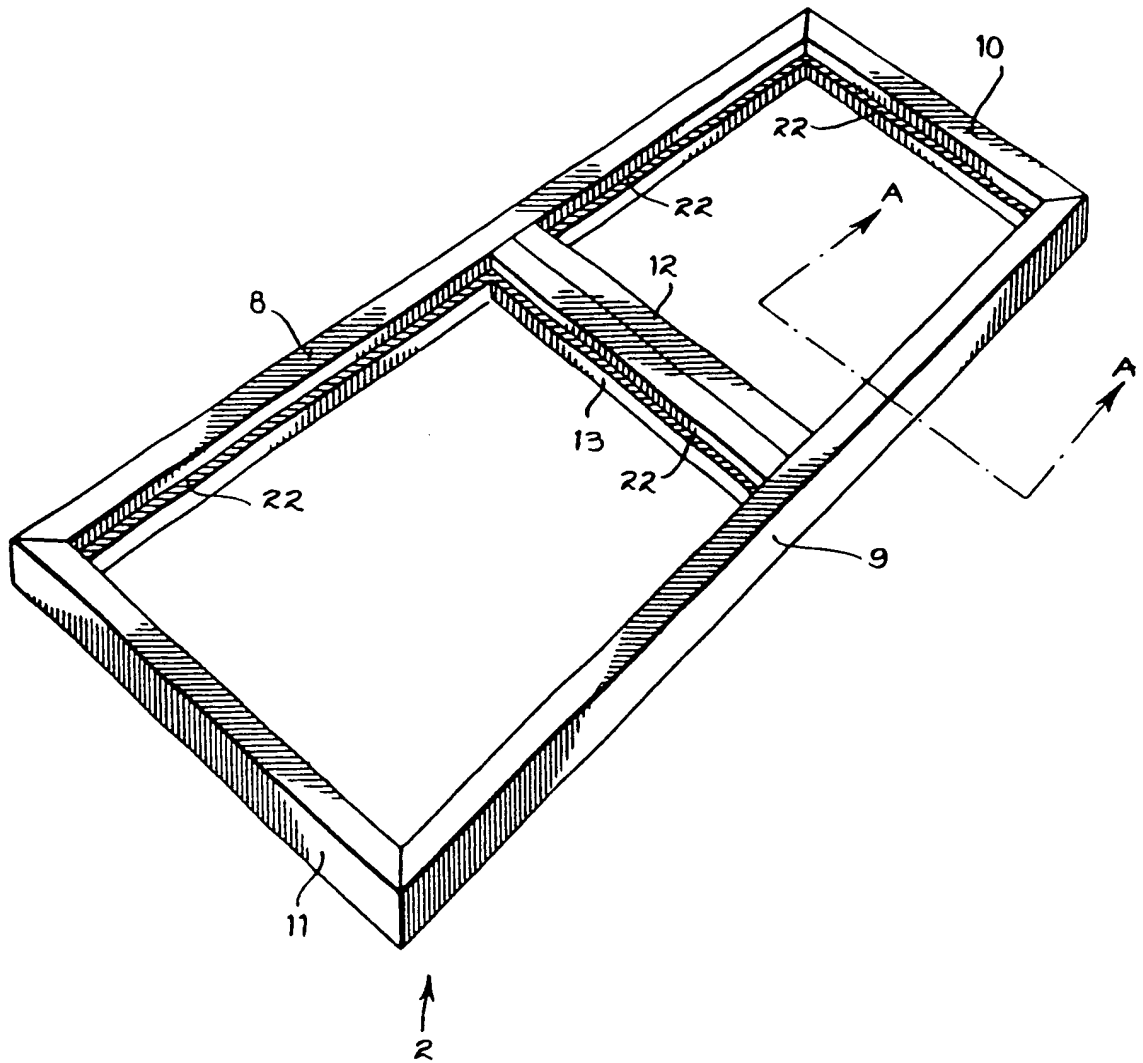
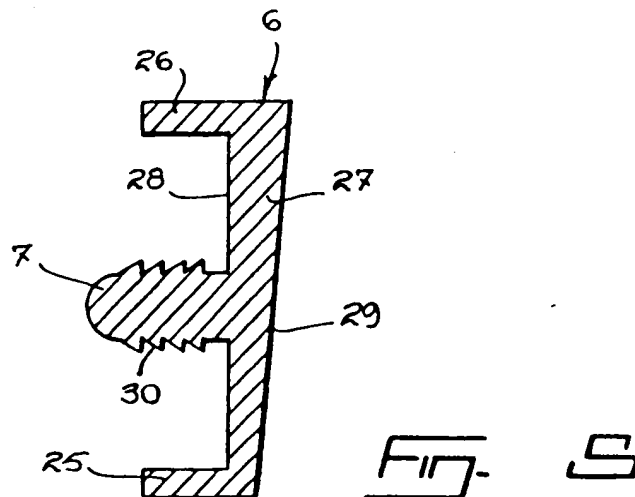
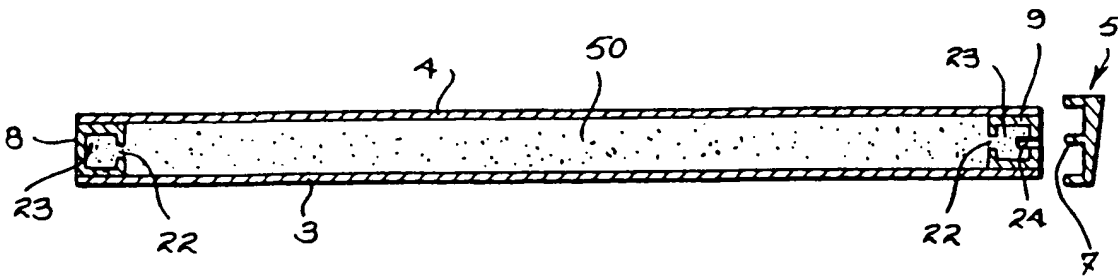
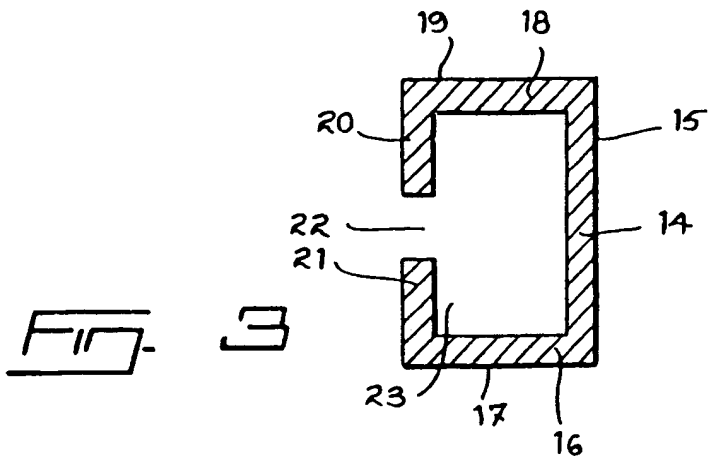


Fig. 2



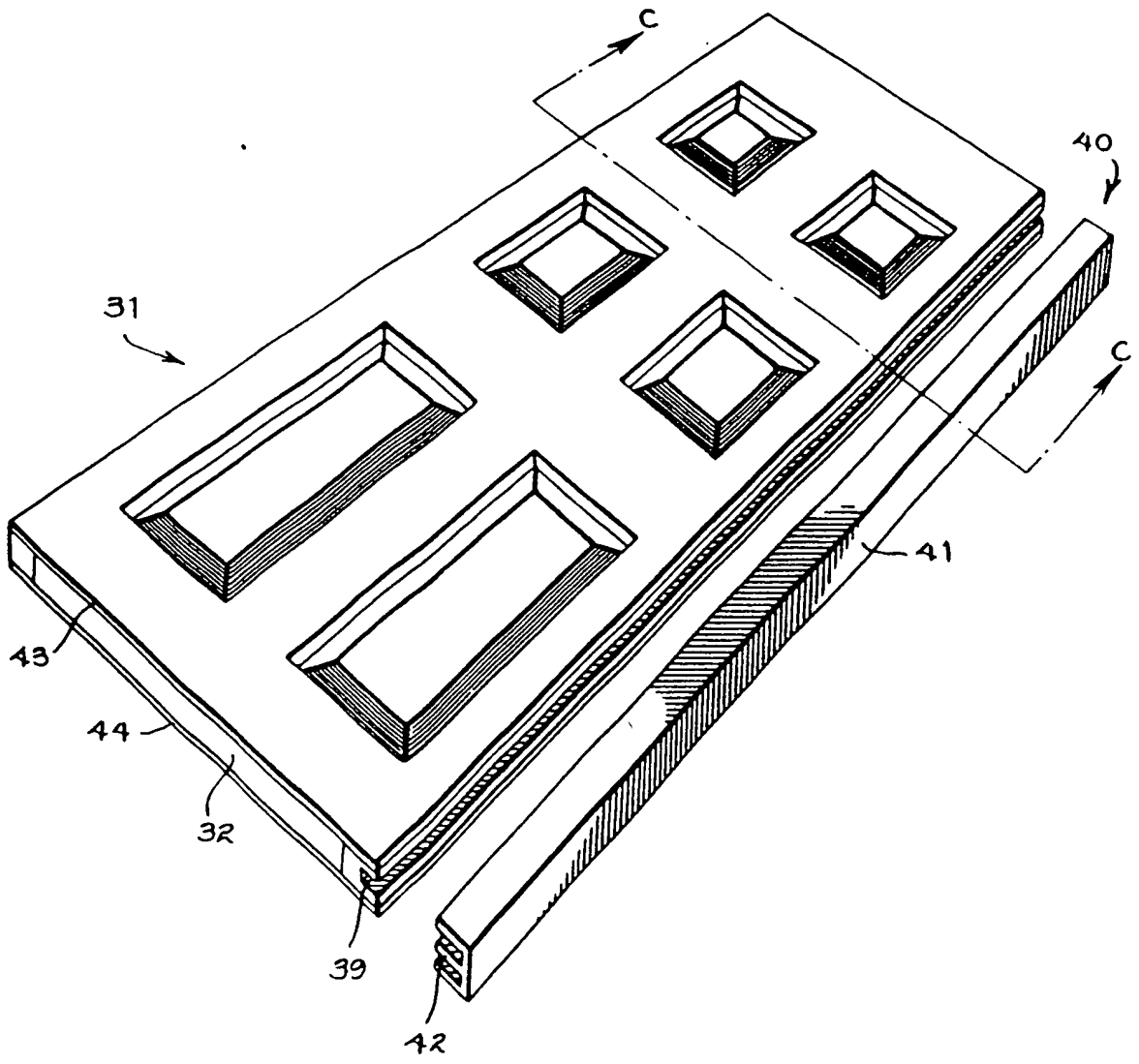


Fig. 6

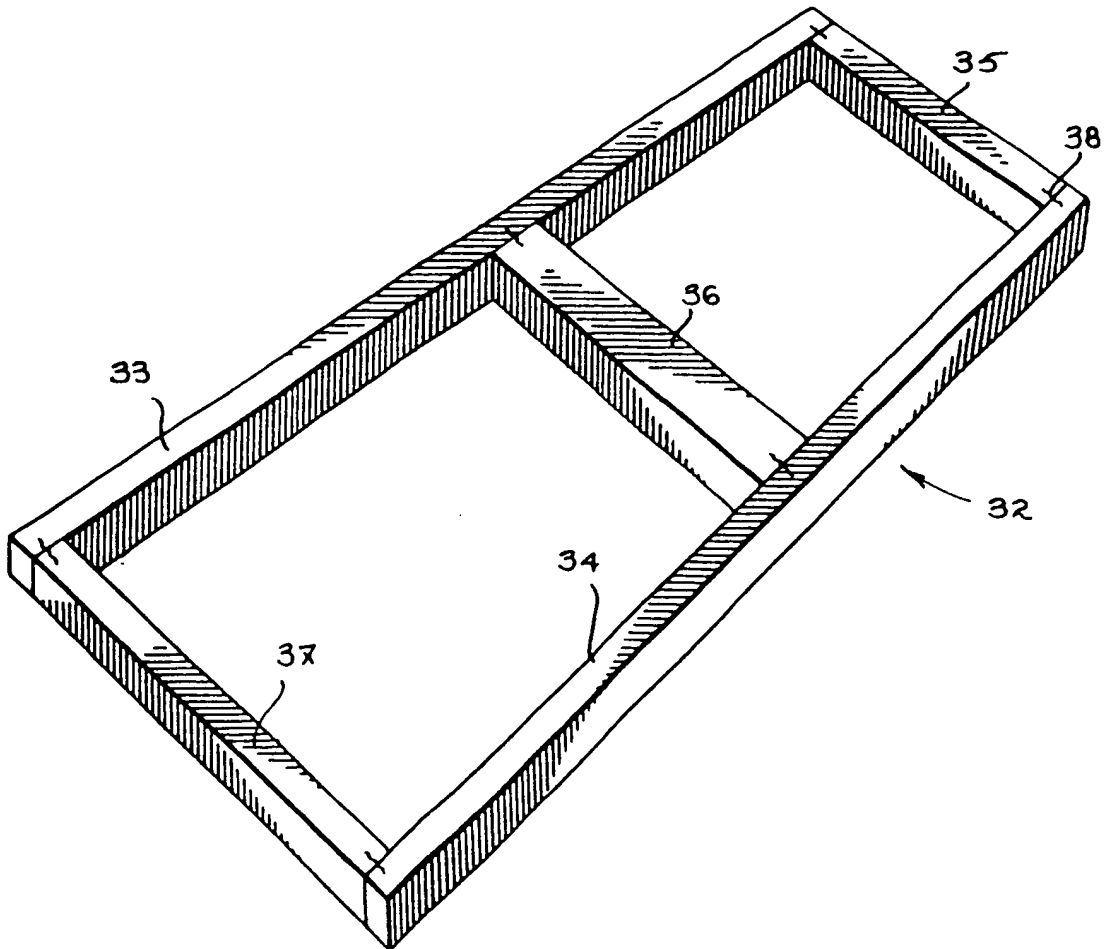


Fig- 7

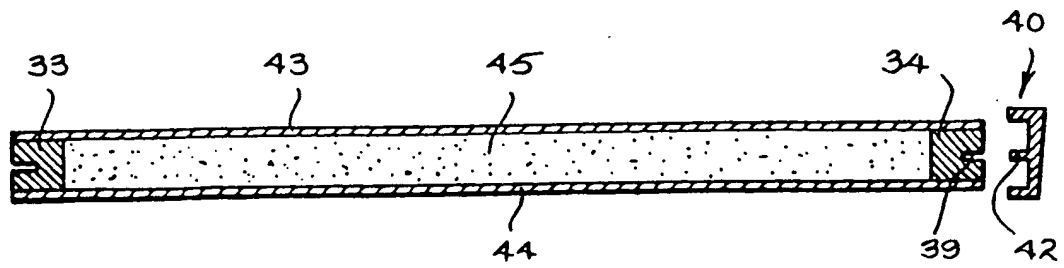


Fig. 8

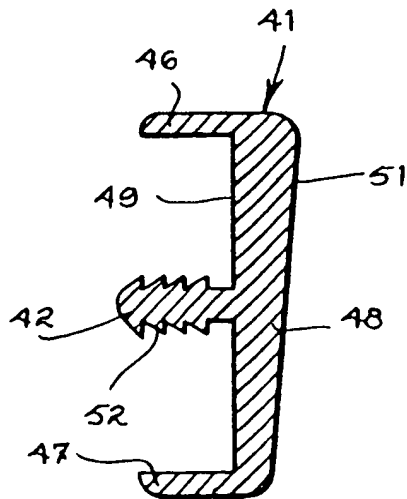


Fig. 9